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NASA TECH BRIEF

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Computer Program Performs Stiffness Matrix Structural Analysis

A computer program has been developed to generate the stiffness matrix for a particular type of structure from geometrical data, and perform static and normal mode analyses.

The program requires the structure to be modeled as a stable framework of uniform, weightless members, and joints at which loads are applied and weights are lumped. The framework and its environment are described by the input quantities from which the program generates the stiffness matrix K.

Static and normal mode analyses are performed which generate the solution to the equations $KU = F$ and $\omega^2 MU = KU$ where F is a matrix of static loads, M is a matrix of inertia terms, U is a matrix of static deflections or a normal-mode shape, and ω is the circular frequency of a normal mode. The necessary eigenvalues and eigenvectors are evaluated by the power method or by Jacobi's method. Member loads are computed from a set of deflections U and geometrical properties of the members.

The thermal loads are computed by first calculating member loads induced by temperature changes with all joints restrained. The program stores the restraint forces at each joint required to prevent joint motion caused by temperature increase. The thermal deflections of joints and thermal loads in members are obtained by superimposing the member loads evaluated above with the member loads and joint deflections evaluated by applying to the structure forces equal and opposite to the joint-restraining forces.

Notes:

1. This program is written in Fortran II for use on the IBM 7090/7094 computer.
2. This program has been used extensively during the design of spacecraft and will be extremely useful to many engineers engaged in structural analysis. It can be used by personnel who have had little training in computer utilization since input can be easily revised to reflect changes in a design.
3. Inquiries concerning this program may be made to:
   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B68-10096

Patent status:

No patent action is contemplated by NASA.

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(NPO-10502)

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